San José State University
Aerospace Engineering Department
AE 172 A – Spacecraft Design I

Fall 2017

Course and Contact Information

Instructor:	Dr. Periklis Papadopoulos
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Office Hours:	TR 4:30 – 6:00 and by appointment
Class Days/Time:	TR 3:00 – 4:15 pm
Classroom:	Engr. 164
Prerequisites:	Must be "senior" in good academic standing. AE20, AE162, AE165, Engr100W Completion of core GE
Co-requisites:	AE164, AE168, Engr195A

Course Description

This is the first course in a two-semester sequence in which students work in teams to complete the conceptual and preliminary design of a spacecraft. Students are challenged to consider the relationship of aerospace engineering to the broader community. Meets GE areas S and V when course is taken in combination with: AE 172B, Engr195A and Engr195B.

Course Goals

1. To provide senior engineering students a capstone experience in spacecraft design.
2. To offer an opportunity for going beyond a paper product (design report) into actual manufacturing and launching of microsatellites.
3. To develop students' creative abilities in solving open-ended, spacecraft design problems.
4. To develop an appreciation of the interrelationships between aerodynamics, propulsion, structures, flight mechanics, stability & control, manufacturing, maintenance, and cost in an integrated spacecraft design.
5. To develop students' engineering judgment as well as their confidence in making and accepting responsibility for design decisions.

6. To develop students' oral and written communication skills, necessary to describe the assumptions, methods, and results of engineering analysis, synthesis, and decision making associated with spacecraft design.
7. To make students aware of the importance of teamwork in the design of a spacecraft and provide them with an opportunity to develop team and leadership skills.
8. To make students aware of their professional and ethical responsibilities as practicing engineers.
9. Discuss the role of identity, equality, social actions, and culture in aerospace engineering practice. (Integration of Area S and Engineering.)

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

GE Area S–LO1: *Describe how identities (i.e. religious, gender, ethnic, racial, class, sexual orientation, disability, and/or age) are shaped by cultural and societal influences within contexts of equality and inequality.*
BSAE LO–D: *Ability to collaborate with people from different cultures, abilities, backgrounds, and disciplines to complete aerospace engineering projects.*
BSAE LO–H: *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195A ***Reflection Paper 3*** (700-800 words): In this reflection paper, you are to critically engage the topic of the social construction of identity in your life. Please discuss and provide examples of how at least one of your identities (i.e., religious, gender, ethnic, racial, class, sexual orientation, disability and/or age, among others) is shaped, or has been shaped, by cultural and societal influences within contexts of equality and inequality. Please integrate course material (concepts, theories, discussions, lectures, readings). Please cite at least one course reading.
- AE172A – ***Essay 4*** (minimum 500 words): *Consider your identity as a future aerospace engineer. How is your identity shaped by cultural and societal influences within contexts of equality and inequality?*

GE Area S–LO2: *Describe historical, social, political, and economic processes producing diversity, equality, and structured inequalities in the U.S.*
BSAE LO–D: *Ability to collaborate with people from different cultures, abilities, backgrounds, and disciplines to complete aerospace engineering projects.*
BSAE LO–H: *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195A ***Reflection Paper 2*** (700-800 words): Consider technological innovations and developments in your field. In your paper: 1) Describe, in detail, an example of how one such innovation/development (using any example that you want post-1970) has either increased or decreased environmental or social justice and inequality in the U.S. Make sure to discuss what the technological development is and its environmental or social consequence(s). 2) Looking forward, can you predict any other possible unintended environmental and/or consequences from this branch of technology? 3) Next, discuss how your current or past projects have or will contribute to environmental and/or social justice or injustice in the United States. Include at least two citations. You can cite two course readings or you can have one citation from a course reading and one citation from the movie "Secrets of Silicon Valley." Either way you need two. Citing lecture will not count as one of these citations for this paper.
- AE172A – ***Essay 2*** (minimum 500 words): Describe how space technology has contributed to the historical, social, political, and economic processes producing diversity, equality and/or structured inequalities in the U.S and the world. Include at least two citations, not including course readings or lecture.

GE Area S–LO3: *Describe social actions, which have led to greater equality and social justice in the U.S. (i.e. religious, gender, ethnic, racial, class, sexual orientation, disability, and/or age).*
BSAE LO–G: *Broad education to understand current events, how they relate to aerospace engineering, as well as the impact of engineering solutions in a global and societal context.*
BSAE LO–H: *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195A ***Refection Paper 2*** (700-800 words): Consider technological innovations and developments in your field. In your paper: 1) Describe, in detail, an example of how one such innovation/development (using any example that you want post-1970) has either increased or decreased environmental or social justice and inequality in the U.S. Make sure to discuss what the technological development is and its environmental or social consequence(s). 2) Looking forward, can you predict any other possible unintended environmental and/or consequences from this branch of technology? 3) Next, discuss how your current or past projects have or will contribute to environmental and/or social justice or injustice in the United States. Include at least two citations. You can cite two course readings or you can have one citation from a course reading and one citation from the movie "Secrets of Silicon Valley." Either way you need two. Citing lecture will not count as one of these citations for this paper.
- AE172A – ***Essay 3*** (minimum 500 words): Describe one historical example of how space technology has increased (or hindered) social justice in the U.S. and the world. Include at least two citations, not including course readings or lecture.

GE Area S–LO4: *Recognize and appreciate constructive interactions between people from different cultural, racial, and ethnic groups within the U.S.*
BSAE LO–D: *Ability to collaborate with people from different cultures, abilities, backgrounds, and disciplines to complete aerospace engineering projects.*
BSAE LO–H: *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195A ***Reflection Paper 1*** (700-800 words): Students will read excerpts from Ernest Callenbach's *Ecotopia.* Students will apply this reading to their current lived experience in the U.S. Beyond fulfilling the S-LO4, students will address the specific course learning objective "identify, compare, and contrast how local community organizations, groups, and agencies address social issues relevant to the environment and quality of life in the Santa Clara Valley" by comparing one element in our current society to Callenbach's described society.
- AE172A – ***Essay 1*** (minimum 500 words): Consider a negative side effect of space technology. Find at least three references that discuss this effect. Are there any organizations that work to alleviate these effects in your community? Visit one of these organization websites or visit their local office in person and describe the interactions between this organization and the larger community. Make sure you cite all your sources.

BSAE LO–C: *Ability to perform conceptual and preliminary design of aircraft or spacecraft to meet a set of mission requirements within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.*

1. Define an appropriate set of mission requirements for a spacecraft.
2. Define, calculate, and evaluate measures of merit (MOM) for a spacecraft.
3. Perform a literature search and collect data to show the need for a particular spacecraft. ***(ABET Outcome H:*** *Recognition of the need for, and ability to engage in life-long learning.)*

4. Design spacecraft hardware.
5. Apply the complete product development cycle: basic idea / societal need / market study / economic and budget analysis.
6. Create the baseline design of a spacecraft.
7. Establish the final design of a spacecraft.
8. Evaluate / analyze the operation of a spacecraft as well as any data relayed.

BSAE LO–D: *Ability to collaborate with people from different cultures, abilities, backgrounds, and disciplines to complete aerospace engineering projects.*

9. Work harmoniously and effectively in a team to solve engineering problems related to the design of a spacecraft and to communicate the results in technical reports and oral briefings.
10. Communicate effectively in a team environment, negotiate and resolve conflicts, motivate and coach others in your team, organize and delegate work as needed, develop a team vision and set team goals, and manage resources.
11. Evaluate your own performance as well as that of your teammates using specific criteria, such as the quality of their work, their commitment to the team / project, leadership skills, responsibility, abilities, communication skills, and personality.

Project Management
12. Develop a milestone schedule (timeline) for an engineering project and follow it.

BSAE LO–F: *Understanding of professional and ethical responsibility.*

13. Identify possible courses of action, discuss the pros and cons of each one, and decide on the best one, given a job-related scenario that requires a decision with ethical implications.

BSAE LO–E: *Ability to communicate effectively through technical reports, memos, and oral presentations as well as in small group settings.*

14. Write high quality design reports (i.e., using correct language and terminology, correct technical information, and professionally prepared graphs and tables).
15. Give clear, informative, technically correct oral presentations using professionally prepared visual aids.

Relationship of CLOs to BSAE Student Learning Outcomes

	BSAE Student Learning Outcomes								
	A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***
Course Learning Outcomes									
1 – 8	B		C					C	C
9 – 12				C	C			C	
13						C		C	
14 – 15					C				
GE Area S–LO1							C	C	
GE Area S–LO2							C	C	
GE Area S–LO3							C	C	
GE Area S–LO4				C			C	C	

NB: The letters inside the table indicate the highest level of skill achieved by the LOs on the left hand side. "B" corresponds to levels 3 or 4 in Bloom's Taxonomy; "C" corresponds to levels 5 or 6 in Bloom's Taxonomy.

Text: Instructor's Notes

Final Examination / Evaluation

The 2nd oral presentation and oral examination will take place at the time of the scheduled final exam.
The final project reports will also be due at this time.

Grading

The course grade is determined as follows:

- 70% based on team performance (design reports); individual scores are determined by peer evaluations.
- 20% based on additional assignments:
    - GE Area S / BSAE LO–G, LO–H: Essays 1, 2, 3, and 4.
    - BSAE LO–F: Case studies on safety, ethics, and liability issues (reflection papers).
    - **NB-1: Even if you score 100% on the technical (design) part of the course, you will NOT receive a passing grade UNLESS you also average 70% or higher on all assignments within each of the following categories:**
        1. Assignments that address BSAE LO–F
        2. Assignments that address GE Area S / BSAE LO–G, LO–H
    - **NB-2: Your papers will suffer a significant point reduction and/or may be returned ungraded if they are deficient in one or more of the following areas:**
        - Grammar and spelling are not at an acceptable level for an advanced GE course / capstone, senior design experience.
        - References are not included or are not cited in the text.
        - References listed do not follow APA or AIAA rules.
        - Fewer than 3 journal articles are used / cited in your paper.
        - Supporting materials are too old (older than 5 years)
        - Turnitin.com plagiarism check was positive (except in the "References" section)
        - Assignment was submitted late.
- 10% based on your collaboration with and mentoring of AE20 and AE30 students. In particular, you are expected to:
    - Explain your design project to AE20 / AE30 student teams assigned to you.
    - Assign simple CAD and programming tasks related to your project to each AE20 / AE30 team.
    - Be available to meet with AE20 / AE30 student teams assigned to you and provide mentoring to them as needed.

Determination of Grades

Grade	Minimum Score
A+	950
A	900
A-	850

B+	800
B	750
B-	700
C+	675
C	650
F	649 or lower

AE172A – Spacecraft Design I – Fall 2017
Approximate Weekly Schedule

Week	Date	Topics
1	8/24/2017	Introduction to spacecraft design
2	8/29/2017	Mission requirements
3	9/5/2017	Systems specifications documentation
4	9/12/2017	System decomposition
5	9/19/2017	Subsystem design
6	9/26/2017	Subsystem specification documentation
7	10/3/2017	Subsystem design review ***Essay 1 (GE Area S) Due***
8	10/10/2017	System design and integration
9	10/17/2017	System/ subsystems coupling
10	10/24/2017	**Discussion:** How spacecraft fit into the historical, social, political, and economic processes producing diversity, equality, and structured inequalities in the U.S. and the world.
11	10/31/2017	Case study on ***aircraft safety, ethics and liability issues:*** V-Tail Bonanza ***Essay 2 (GE Area S) Due***
12	11/7/2017	**Discussion:** Consider the technological innovations in spacecraft design, describe a historical example, and indicate how it has increased social justice in the U.S. and the world.
13	11/14/2017	Subsystems design review. ***Essay 3 (GE Area S) Due***
14	11/21/2017	Subsystems design review.
15	11/28/2017	Case study on ***aircraft safety, ethics and liability issues:*** The Crash of AA191

Week	Date	Topics
16	12/5/2017	Detailed design review. ***Essay 4 (GE Area S) Due***
Final Exam		***Final design review.***

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/

AE Department Policies http://www.sjsu.edu/ae/programs/policies/

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on my faculty web page at http://www.sjsu.edu/people/firstname.lastname and/or on Canvas Leaning Management System course login website at http://sjsu.instructure.com. You are responsible for regularly checking with the messaging system through MySJSU at http://my.sjsu.edu (or other communication system as indicated by the instructor) to learn of any updates.